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AUTHOR Trickett, Penelope K.
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ABSTRACT

Much research shows that the correlation between IQ and school performance is consistently high. However, some evidence indicates that this relationship is not consistent but is moderated by classroom psycho-social environment at the first-grade level. Data from IQ tests, the Devereux Elementary School Behavior Rating Scale, number of attendance days, overall academic teacher ratings, and the Pier-Harris Children's Self-Concept Scale were collected from 189 students in one of three types of self-contained first-grade classrooms: open, intermediate, and traditional structure. Findings indicated that, in general, IQ and school performance were highly related in traditional classroom settings, particularly for the two most achievement-oriented school performance dimensions, but only minimally related in the intermediate classroom settings. (Author/KMF)

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Classroom Environment as a Moderator of the IQ - School Performance Relationship

Penelope K. Trickett

Laboratory of Developmental Psychology

National Institute of Mental Health

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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There is much research that shows that the correlation between IQ and school performance is more consistent and of a greater magnitude than most correlations found in psychological research. Over the years there has been considerable controversy over the meaning of these findings (see, for example, Jensen, 1972; McClelland, 1973). But what has received much less attention is the fact that a lot (perhaps half) of the variance in school performance is not accounted for by IQ. Nor have there been systematic research efforts explicitly designed to determine whether this IQ-school performance relationship remains consistently high over different types of education environments or experiences.

This study examines these issues by investigating whether the overall educational approach of the teacher (as reflected in the Psycho-Social environment of the first-grade classroom) acts as a moderator variable of the IQ-school performance relationship. The study considers both directly achievement-oriented aspects of school performance (teacher ratings of academic performance) and less achievement-oriented school performance (ratings of classroom behavior and school involvement, self-esteem, and school attendance).

METHOD

Subjects

Subjects were first-grade children enrolled in public schools in two adjacent small towns in southern Connecticut. A total of 14 first-grade classrooms in seven schools were included in the initial phase of the study. On the basis of ratings on a revised version of the Troutt Openness of Classroom Rating Scale (which is described below), nine of these classrooms were selected for further study. Subjects were all the students in these

nine classrooms. The total population of these nine classrooms was 202. The final N was 189. Two Puerto Rican students who had difficulty with English were not included and 11 students were not included due to parental objection. There were 92 boys and 97 girls. The sample was 92% White, 2% Black, and 5% Puerto Rican. All 11 Puerto Rican students included in the sample were proficient in English. A rough estimate of social class was derived from ratings on the Hollingshead Occupational Rating Scale which was filled out by the principal or teacher of each child. The median occupational level was four on a seven-point scale. The mean age for the total sample was 85 months with a range of 76 to 112 months. The mean IQ as measured by the Otis-Lennon Mental Ability Test was 112 with a standard deviation of 14.40 and a range of 72 to 148.

Measures

Classroom Climate

The measure of classroom climate employed was a revised version of Troutt's (Note 1) Openness of Classroom Rating Scale. The Troutt is an observational rating scale consisting of 35 items about student and teacher classroom behavior which are rated on a five-point scale by the observer. The items reflect elements of the open education approach toward education, covering such content as the physical organization of the classroom, individualization of work space, student choice and individualization of curriculum, and the style of teacher participation in the classroom. Troutt (Note 2) reports interjudge reliabilities averaging around .70 and test-retest reliability averaging around .60. Troutt's observers based their ratings on a one-hour observation of each classroom. Because the test-retest reliabilities found by Troutt were somewhat low, it was decided to revise the nature of the observations in order to optimize the chance that

they would capture a representative sample of the overall style of the classroom by observing each classroom for two half-hour morning sessions at different times on different days and for two half-hour afternoon sessions at different times on different days.

The observers, two women with considerable classroom experience, were trained in second-grade classrooms in one of the participating schools. Both observed the same classroom, filled out the Troutt independently and then compared ratings. This process was continued until a very high inter-rater agreement resulted--on 100% of the Troutt items the observers' scores did not differ by more than one point and the mean scores obtained were within five points of one another.

For the present study, this measure was revised after correlations were run between the items of the scale and the total scale score. All items which correlated less than +.40 with the total score were deleted, resulting in a 23 item scale. The total score on this Revised Troutt Rating Scale correlated .86 ($p < .001$) with a one-item scale of "overall openness" which the observer's completed and .83 ($p < .001$) with the same rating of overall openness made by the principals at each school.

IQ

IQ as measured by the Otis-Lennon Mental Ability Test was obtained for each subject. In six of the nine classrooms in the study, the Primary II Level, Form J, of this test had been administered as part of the standard school procedure about three months prior to the beginning of this study and these scores were used. For the other three classrooms, IQ measures were not given as a standard procedure. So the author administered the Elementary Level, Form J (the level appropriate for second semester first-graders) to these classrooms.

School Behavior and Performance Measures

Classroom Behavior. Each teacher filled out the Devereux Elementary School Behavior Rating Scale (DESB) for each student in her classroom. This measure, developed by Spivack and Swift (1966, 1967), consists of 47 items relating to a child's classroom behavior that are rated on either a 5- or 7-point scale by his/her classroom teacher. These 47 items are grouped into 11 scales (of 3 to 5 items each). The DESB manual (Spivack and Swift, 1967) reports the median test-retest reliability (one week interval) to be .87. Normative data based on a sample of 809 school children are reported as is some evidence about the relationship between school achievement and scores on the DESB which supports the construct validity of the measure. A recent study by Schaefer, Baker and Zawel (1975) reports interater reliabilities ranging from .61 to .87 for the 11 subscales with a median of .80.

The items of the DESB are worded in such a way that the teachers are rating observable behaviors and are required to do little interpretation (e.g., "Seek out the teacher before or after class to talk about school or personal matters: Quickly drawn into the talking or noisemaking of others [i.e., stops work to listen or join in?]") The directions instruct the teacher to rate the degree to which the child manifests this behavior as compared with the average child in the normal classroom situation.

Overall Academic Standing. Each teacher rated the overall academic standing of all her students by a q-sort technique. She was given the names of all the students in her classroom typed on separate pieces of paper and instructed to rate her students on a five-point scale (from "in the lower 20% of the class" to "in the upper 20% of the class") by sorting them into five approximately equal-sized groups and then to attach each group of names to the appropriate number by paperclip.

Self Concept. All subjects were administered a shortened version (even items) of the Piers-Harris Children's Self Concept Scale. The full Piers-Harris consists of 80 true-false items. The manual (Piers, 1967) describes considerable evidence of the adequate reliability of the scale--tests of internal consistency have ranged from .78 to .90 and test-retest correlations (two and four month intervals) range from .71 to .77. The manual also reports some research evidence bearing on the validity of the scale and normative data based on a sample of 1183 school children.

In the present study, the Piers-Harris was administered on an individual basis to each child. The experimenter read aloud each item and recorded each response on a separate answer sheet. She defined any words that the subject did not understand. Seven scores are obtained from the Piers-Harris, the total scale score and six "cluster" scores which are based on the factor analysis of the scale. These six subscale scores are called Behavior, Intellectual and School Status, Physical Appearance and Attributes, Anxiety, Popularity, and Happiness and Satisfaction.

Attendance. The total number of days absent from school for the entire school year were recorded for each subject at the completion of the school year.

Procedure

Observations of the Classrooms

Each of the 14 first-grade classrooms involved in the study was observed by one of the observers for four one-half hour sessions as previously described. After the fourth session, the observer filled out the Troutt scale for that classroom. When the observation of all 14 classrooms was complete, the statistical procedures previously outlined were undertaken resulting in the Revised Troutt Rating Scale.

Selection of Participating Classrooms

The total raw scores for each of these classrooms on this Revised Troutt Scale ranged from 44 to 97 (out of a possible 23 to 115) with a mean of 69.07 and a standard deviation of 15.42. On the basis of these scores, nine classrooms representing three levels of degree of open education were chosen for further study in the following manner. The three classrooms with the highest (most open) scores were chosen for Level I. Their mean Troutt Score was 90.33. The three classrooms with the lowest scores (with a mean of 49.0) were chosen for Level III. And the three intermediate classes which clustered around the overall mean were chosen for Level II. The mean of these three classrooms (69.67) closely approximates the mean for the total sample. Note that the means for Level I and Level III are more than one standard deviation from the total sample mean.

Individual Testing of the Subjects

Each student in these nine classrooms are individually administered the Piers-Harris Self Concept Scale by one of four female experimenters in a small room in each school. At the same time the teachers were given a packet containing the Devereux Elementary Classroom Behavior Rating Scales and the Overall Academic Standing Scale. Each teacher was paid to compensate for her time. School attendance figures were gathered at the end of the school year.

RESULTS

The scores on school behavior and performance measures were factor analyzed using the principal components method and six factors with latent roots greater than one were found. These six facors, which accounted for 69.7% of the total variance, were rotated by Varimax. Table 1 lists these factors and their names, two or three defining items for each factor and their factor loadings. As can be seen, Factors I, III, IV, and VI represent primarily subscales of the DESB:

Factor II represents the total scale and some subscales or the Pier-Harris: and Factor V represents primarily school absences. Interestingly, the four factors which represent aspects of the DESB are quite similar to factors found by Schaefer, Baker and Sawel (1975), which suggests that the date of the present study are not idiosyncratic.

Preliminary analyses showed that for four of these six factors there was no difference in mean level for the three classroom types. The exceptions were (1) that the children in the open classrooms were rated higher in Classroom Disturbance than children in the other two types of classrooms (with those in the Intermediate classrooms being rated as lowest) and (2) that boys, but not girls, in the Open classrooms were rated as higher in Achievement Anxiety than those in the other two types of classroc s. Preliminary analyses also revealed no difference in mean IQ level of the three classroom types.

The relationship of IQ to the six dependent factors within the three classroom types was determined through use of an infrequently used technique known as factor extension. When, as in this study, factor analysis is undertaken on many dependent variables with the resulting factors used as the final dependent variables, it is possible to "extend" other variables on these same factors to predict how they would have loaded had they been included in the factor analysis and interpret the resultant loadings much as one would any loadings in a factor analysis. (See Guilford & Hoepfner, 1971, for more details.)

Figure 1 illustrates the results of the extension of IQ on the dependent factors. On the X axis of this graph are placed the six dependent factors. On the Y axis are the factor loadings. For the purposes of clarity, the factor extension loadings are plotted such that anything above the horizontal

line represents good adjustment and anything below the line represents poor adjustment. That is, a high positive loading means low classroom disturbance, high self esteem, able and self reliant learner, high classroom involvement, few school absences, or low achievement anxiety. Because of the small size of the samples for each classroom level, it was necessary to run the factor extensions for boys and girls combined.

This figure clearly shows that, as would be expected, IQ has an overall positive relationship with the dependent variables. However, this relationship varies considerably according to classroom structure. The importance of IQ is rather minimal in the Intermediate structure classrooms. The largest loading is .27 on School Involvement. Surprisingly, IQ loads only .20 on Able and Self-Reliant Learner for this classroom type. By contrast, IQ has large loadings on the dependent variables for the Traditional structure classrooms. It loads .63 on Able and Self Reliant Learner, .54 on low Achievement Anxiety, .53 on School Involvement and .39 on (low) Classroom Disturbance. The Open structure classrooms are in an intermediate position: IQ loads .46 on Able and Self Reliant Learner, .33 on School Involvement and .30 on (low) Classroom Disturbance.

DISCUSSION

These results demonstrate that the relationship between IQ and School Performance Measures varies substantially across types of first-grade classrooms. What is perhaps most interesting is that it is in the traditional classrooms that the relationship between the most achievement-oriented dependent factor, Able and Self Reliant Learner, and IQ is the highest and most similar to that usually reported in the literature. This finding raises the distinct possibility that the consistency of findings in the literature

reflects a predominance of traditionally organized classrooms in our schools (and, thereby, in our research samples) which, coupled with data analytic techniques based on sample averages, have masked important variability in the relationship between school performance and IQ from classroom to classroom.

It is significant that it is in the same type of classrooms where IQ is most highly related to classroom academic performance (i.e., the traditional classrooms), that IQ is also most highly related to the factors of School Involvement, Achievement Anxiety, Classroom Disturbance, and, to a lesser extent, School Absences. Perhaps, if doing well in school is tied closely to IQ, those students with lower IQ's became more anxious and less involved in school and express their frustration through higher rates of classroom disturbance.

Another finding of note is that in this study the relationship of IQ and school performance is not linearly related to the traditional open classroom continuum. Rather, for all the factors except self-esteem, the greatest contrast is between the traditional classrooms and the intermediate classrooms. How is this to be explained? How do the traditional and intermediate classrooms differ? Inspection of the pattern of scores on the Troutt Scale reveals that the Intermediate Classrooms in this sample are very much like the Traditional Classrooms in the physical organization of the classroom--they did not contain work stations or individual workspace. Concomitantly, the freedom of the child to choose where and on what to work is limited. On the other hand, the intermediate classrooms were rated very much like the most open classrooms on items relating to the teacher acting as an active facilitator or resource person, high student--student involvement, and student

access to and involvement with a variety of classroom materials. It appears that the intermediate classrooms in this study were characterized by both high teacher control and structure and a lot of teacher-student and student-student involvement. Why these combinations of characteristics should result in a different pattern of relationships between IQ and school performance than exists for the traditional classrooms cannot be answered by the present study but provides an intriguing question for further inquiry.

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TABLE 1

Principal Components Factor Analysis of the School Performance Variables: Names given the Factors, Defining Items, and their Loadings

Factor Name	Defining Items	Loading
FACTOR I		
Classroom Disturbance	DESB[a] - Disrespect - Defiance	.863
	DESB - Classroom Disturbance	.842
	DESB - Irrelevant Responses	.673
FACTOR II		
Self Esteem	Piers-Harris - Total Score	.960
	Piers-Harris - Low Anxiety Scale	.780
	Piers-Harris - Popularity Scale	.764
FACTOR III		
Able and Self Reliant Learner	DESB - External Reliance	-.844
	DESB - Comprehension	.829
	Teacher Rating - Overall Academic Standing	.825
FACTOR IV		
School Involvement[b]	DESB - Need Closeness to Teacher	.902
	DESB - Creative Initiative	.714
FACTOR V		
School Absences	Total Days Absent	.911
	Piers-Harris Physical Self Esteem	-.322
FACTOR VI		
Lack of Achievement Anxiety	DESB - Achievement Anxiety	-.839
	DESB - External Blame	-.594

[a]Devereux Elementary School Behavior Rating Scale

[b]This factor was named as a result of looking at the individual DESB items constituting the Need Closeness to Teacher and Creative Initiative Subscales which seem to have more to do with a general involvement with the educational process than either subscale name would suggest.

FIGURE 1

RELATIONSHIP OF IQ TO THE

SIX SCHOOL PERFORMANCE FACTORS BY CLASSROOM TYPE